EFFECT OF 75µ GLASS POWDER ON STRENGTH OF REINFORCED CONCRETE

Prof. Sonal Shelar[1], Aniket Jadhav[2], Avdhut Bhoite[3], Swapnil Bandal[4], Akshay Chandgude[5], Ananda Doltade[6]

[1]Dept of Civil Engineering

[1, 2, 3, 4, 5, 6] Trinity College Of Engineering and Research, Pune-48, Maharashtra, India

Abstract- *Cement is the third most energy intensive material after steel and aluminum produced in tones. Cementindustry consumes raw materials rich in silica, alumina, iron and calcium. Therefore this industry has been activelyinvolved in finding ways to use waste products in the manufacturing of cement both as secondary fuel and raw material.Bond strength plays major role in the structural performance of Reinforced Concrete element. Compressive and tensile strength of conventional concrete; influences bond strength of RC element. Glass powder with particle size less than 75 micron when used as cement replacement material; enhances compressive and tensile strength of concrete. In the research work it is proposed to investigate the effect of glass powder as a cement replacement material on compressive and tensile strength of concrete and bond strength in reinforced concrete. The replacement percentage is proposed to be 0% to 40% with an increment of 5%. In addition to creating stresses in the reinforcement and the concrete, flexural deformations of a beam also create stresses between the reinforcement and concrete called bond stresses. If the intensity of these stresses is not restricted, they may produce crushing or splitting of the concrete surrounding the reinforcement, especially if bars are closely spaced or located near the surface of the concrete. Failure of the concrete permits the reinforcement to slip. As slipping occurs, the stress in the reinforcement drops to zero, and the beam which behaves as if it was made of plain concrete is subject to immediate failure as soon as the concrete cracks.*

Keywords- Glass Powder(less than 75µ) , coarse aggregate, cement, fine aggregate , reinforcement steel (Fe 500) .

I. INTRODUCTION

Civil structures are part of every civilization. Reinforced concrete is widely used construction ma-terial in civil structures as it is versatile and inexpen-sive compared to any other building material. Its ability to take any shape allows engineers to use it for mega projects such as high-rise buildings, bridges, tunnels, and airports, as well as for smaller projects such as single story buildings, pavements, parks decks, etc. Thus reinforced concrete structures make significant and important role in the infrastructure development of a Nation. But both condition and performance of all these structures are essential for the development. Every year million tonnes of glass waste is generated. It is the usual practice to dispose of this waste in landfills. Glass being non-biodegradable material does not provide healthy environment. Disposal of this waste is a complex problem for many countries in the world. Recent studies have shown that the particle size of glass is a crucial factor for ASR reaction to occur. In particular, aggregate fineness favour's ASR expansion since the ASR reaction is a surface area dependent phenome-non. It was found that if glass was ground to a particle size of 300µm or smaller, the ASR induced expansion could be reduced. The data reported shows that if waste glass is finely ground under 75µm, this effect does not occur and mortar durability is guaranteed. It provide better bond strength between concrete and reinforcement and increases compressive as well as tensile strength.

II. PROBLEM STATEMENT

The present day world is witnessing construc-tion of very challenging and difficult civil engineering structures. To determine the performance of the glass powder on the behaviour of the concrete such as structural behaviour and to find the solution to make sustainable concrete. This study deals with the effect of glass powder on bond strength of rein-forced concrete structure.

III. LITERATURE REVIEW

3.1 Title – Effect of compressive and tensile strength of conventional concrete on bond in reinforced con-crete

Author - Hasan Sahan Arel & Semsi Yazıcı (2012)

Have investigated the effect of depth of concrete cover and curing time on bond strength in RCC with different compressive strengths. Total 384 speci-mens; cube and cylindrical 192 each were casted for investigation. Cube specimens of size 150mm x 150mm x 150mm and cylindrical specimens 150mm diameter and 300mm height was used.

Cubical pull-out specimens of size 150mm x 150mm x 150mm with centrally located 14mm diameter bar of em-bedment length 70mm (5 times bar diameter) were casted. The specimens were tested at the age of 3, 7, 14 & 28 days. They found that load required to pull the embedded reinforcement increases with in-crease in the tensile strength and compressive strength of concrete. The relationship between pullout load and compressive strength; pullout load and tensile strength at the age of 28 days respec-tively.

3.2 Title – Effect of glass powder on workability of concrete

Author - Jitendra B. Jangid, Prof. A. C. Saoji (2014)
Publisher and Year - IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X

In this paper the experimental investigation on the use of glass powder in partially replacement cement in concrete applications and summarized the behav-iour of concrete involving partial replacement of cement by waste glass powder 5% to 40% at interval of 5% each. The material used were cement, sand, coarse aggregate, glass powder and water. The M30 grade of concrete with proportion of 1:1:2. Higher strength was obtained when 20% cement was re-placed by waste glass powder and Workability de-creases as percentage of glass powder increases.

3.3 Title - Effect of glass powder on compressive strength of concrete

Author - Dr. P. R. Kumar and Shilpa Raju (2014)

Publisher and Year - IJIRSET An ISO 3297: 2007 Cer-tified Organization Volume 3, Special Issue 5, July 2014

Investigated effect of glass powder as cement re-placement material on compressive strength of con-crete. Cube specimens of size 150mm x 150mm x 150mm were casted using M20 grade of concrete with w/c ratio 0.50, glass powder with particle size below 75 micron. The cement was replaced with glass powder by 0% to 40% with an increment of 5%. The specimens were tested after 28 day of curing. The test results of glass powder concrete were com-pared with normal concrete. The test results showed that compressive strength of concrete increased with increase in % replacement of cement by glass powder. This increment was due to reaction with cement hydrates and some strength is gain by filling the voids in cement.

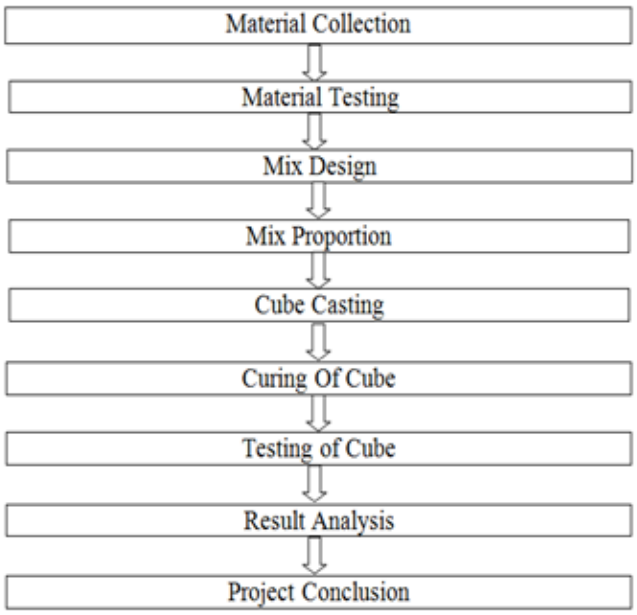
3.4 Title - Utilisation of Waste Glass Powder in Con-crete.

Author - Bhupendra Singh Shekhavat, Dr.Vanita Ag-grawal (2014)

Publisher and Year – IJIRSET (An ISO 3297: 2007 Cer-tified Organization) Vol. 3, Issue 7, July 2014.

Investigated effect of glass powder as cement re-placement material on compressive & tensile strength of concrete. Using M20 concrete mix and w/c ratio of 0.46, cubes and cylinders of dimensions 150mm x 150mm x 150mm and 150mm diameter and 300mm height were casted. The glass powder of size between 90 to 150 micron and below 90 micron was used. The cement was replaced with glass pow-der by 10% to 40% with an increment of 10%. The control specimens were casted using normal con-crete with 100% cement content as per mix design and cement content ranging from 90% to 70% that of mix design. The specimens were tested after 28 days of curing. The test results of glass powder concrete were compared with normal concrete. Workability of concrete increases with waste glass content. Cement can be replaced by waste glass powder up to 20% by weight showing increase in compressive strength at 28 days beyond which strength decreases 20% replacement of cement by waste glass powder showed 18% increase in compressive strength at 7 days and 19% increase in compressive strength at 28 days.

IV. METHODOLOGY



V. SCOPE OF PROJECT WORK

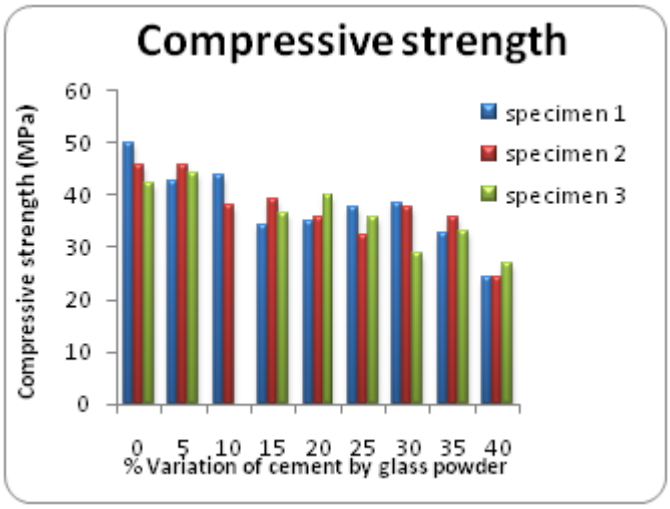
1. To transfer the coming compressive stresses safely to concrete.
2. To transfer the coming tensile stresses safe-ly to other member.
3. Binding the two different material like con-crete and steel to act as a one unit or ho-mogeneous material
4. To study bond mechanism in RC.
5. To study of bond failure in RC.
6. To experimentally investigate the effect of GP on compressive strength of concrete.
7. To experimentally investigate the effect of GP on tensile strength of the concrete.
8. To experimentally investigate the effect of GP on bond strength of the reinforced con-crete.

VI. SPECIMEN TESTING RESULTS

6.1 Compressive Test –

The compressive strength is ob-tained after curing of 28 days at 28 days the com-pressive strength is……..Mpa it will increases in a long period of time and exceeds the compressive strength values of nominal concrete.

Figure 1: Compressive test on cubes

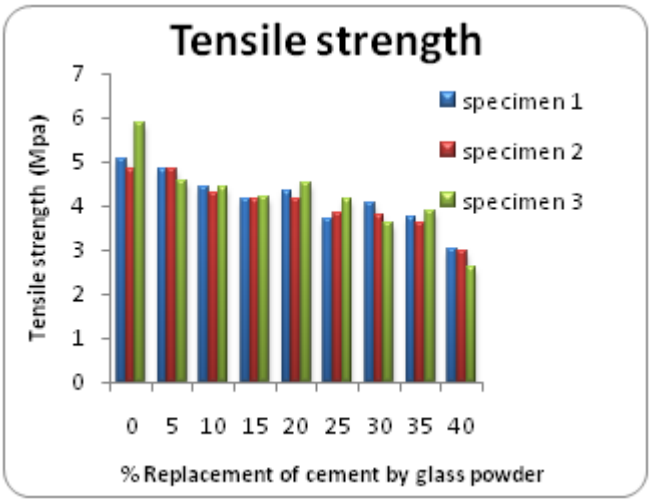


Variation of concrete Compressive strength with % Gp

6.2 Split tensile Test -

The tensile strength is obtained after curing of 28 days at 28 days the tensile strength is…..Mpa. it will increases in a long period of time and exceeds the tensile strength values of nominal concrete.

Figure 2: Tensile test on cylinders

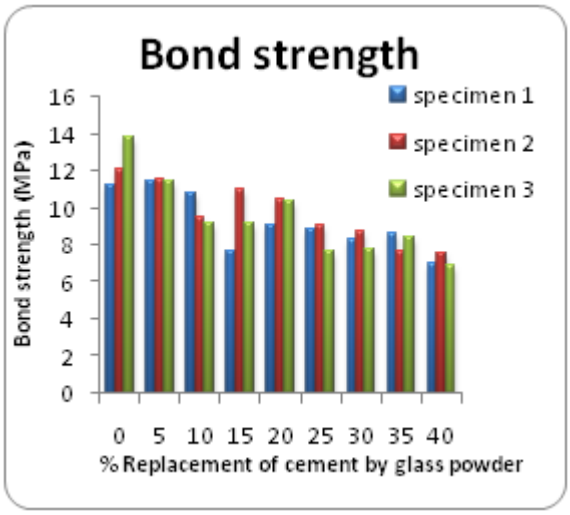


Variation of concrete Tensile strength with %Gp

6.3 Bond Strength -

The bond strength is obtained after curing of 28 days at 28 days the bond strength is……..Mpa it will increases in a long pe-riod of time and exceeds the bond strength values of nominal concrete.

Figure 3: Pull Out test on cylinders



Variation of bond strength of concrete with % Gp

VII. CONCLUSION

From the experimental work and the result analysis the various conclusions can be drawn

1. As percentage of glass powder increases workability decreases.
2. 28 days cube compressive strength and split tensile strength for control M30 was found to be 46.09 MPa and 5.23 MPa respectively.
3. 28 days cube compressive strength of con-crete increases with increases in percentage replacement of cement by glass powder up to 20% ; latter on decreases
4. 28 days spilt tensile strength of concrete in-creases with increases in percentage re-placement of cement by glass powder up to 20% ; latter on decreases
5. Bond strength continuous decreases with increase in percentage replacement of ce-ment by glass powder. This may be due to reduction in chemical adhesion and fric
   tional resistance at interface of steel and concrete
6. All the specimens were failed in splitting mode
7. Strength parameter depends on chemical composition or source.

REFFERANCE

[1] Utilisation of Waste Glass Powder in Concrete Bhupendra Singh Shekhawat1, Dr. Vanita Aggarwal2 M.Tech Final Year Student, Department of Civil Engineering, MMEC, MMU, Mullana Ambala, Haryana, India1 Professor, Department of Civil Engineering, MMEC, MMU,

Mullana Ambala, Haryana, India2 Vol. 3, Issue 7, July 2014

[2] Influence of Waste Glass Powder on Properties of Concrete Amol M. Bar-hate 1, Suraj V. Pawar 2, Vikram Dethe3, Hake S. L.4 U.G. Student, Department of Civil Engineering, G.H.Raisoni Engineering College, Ahmednagar, Maharashtra, India1,2,3 Associate Professor, Department of Civil Engineering, G.H. Raisoni Engineering College, Ahmednagar, Vol. 6, Issue 4, April 2017

[3] Effect of Using Glass Powder in Con-crete Shilpa Raju, Dr. P. R. Kumar Stu-dent, Dept of Civil Engineering, Toc H Institute of science & Technology, Arakkunnam, Ernakulam, Kerala, India1 Professor, Dept of Civil Engineering, Toc H Institute of science & Technology, Arakkunnam, Ernakulam, Kerala, India2

[4] Experimental investigation of waste glass powder as the partial replacement of ce-ment in concrete production Jitendra B. Jangid1, Prof.A.C.Saoji2 1(M.E. Student in Civil Engineering, B.N.College of Engineering Pusad/SGBAU, India) 2(Associate Professor, Department of Civil Engineering, B.N.College of Engineering Pusad/SGBAU, India)

[5] Vol. 5, Issue 12, December 2010 Experimen-tal Study on Use of Waste Glass Powder as Partial Replacement to Cement & Sand in Concret Sayisetti Rajaiah1, AVS Sai Kumar2 & T.Shirisha Asst Prof, Aurora Technological and Management Academy, Parvatapur, Uppal, Hyderabad, T.S, India Asst Prof, Princeton College of Engg & Tech, Ghatke-sar, Hyderabad, T.S, India3 HOD & Asst. Prof, Princeton College of Engg & Tech, Ghatkesar, Hyderabad, T.S, India2